OPTI 424A/524A. Optical Systems Engineering (4 units) Spring. There are three main goals for 524. The first is to provide students an opportunity to synthesize the material they have learned in other classes. In other words, help students understand how to solve problems that use first order optics, radiometry, physical optics, lens design, statistics, etc. The second goal is to teach students about systems engineering. The focus is on understanding the customer's problem, performing a functional decomposition and turning this into a requirements document. The third goal is to give students practical experience in building functional hardware where the solution is not known a priori.

Offered as graduate and undergraduate

Class meets for three 50 min sessions per week with additional time for team meetings to be scheduled.

Grading:
Students will be assigned teams for each case study. Grading is based on the requirements written by each team. If the requirements would solve the customer's problem, and the hardware that is built meets all of the requirements, the team gets an A. If either of these do not happen, the team must say what went wrong, why, and what they would do differently to earn an A.

Graduate students will work on three case studies during the semester

If there are four or more undergraduates, they will be placed on the same team(s). Undergraduates will work on two case studies during the semester. Undergraduates are welcome in the class if there are three or fewer, but they will have to be mixed in with the graduate students, and, therefore, work on three case studies.

Prerequisites: This course is intended for students who have completed 3 semesters or more of optics studies. To complete the case studies, the teams will need to understand the basics of 1st order optics, radiometry, physical optics, aberration theory, detectors, lens design, lab practices and metrology. Students that have been exposed to three or more of these topics or are willing to learn outside of class should have the required knowledge. In addition, many of the case studies will require a basic knowledge of a lens design code, CAD software, Matlab or LabView.

Topics to be covered

Systems Engineering fundamentals
      Defining the statement of the problem
      Functional decomposition
      Establishing requirements
      Systematic design, applied to requirements
      Risk management
      Quality control, reliability

Optical system design
> 1st order architecture studies
> Creative design
> Trade studies
> Detailed design and analysis
> Tolerancing
> Integration and testing

Quantifying system performance
> Image quality metrics
> Sensitivity
> SNR
> Spectral resolving power
> Error analysis/prediction

Professional skills
> Technical writing
> Technical presentations
> Working as part of a team
> Engineering decision making
> Intellectual property
> Introduction to project management
> Introduction to finance
> Career planning

Special Topics
> Stray light
> Illumination – conservation of etendue
> Infrared systems